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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/686,191	10/15/2003	David L. Hagen	P/3474-86	3800

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EXAMINER	
SOOHOO, TONY GLEN	
ART UNIT	PAPER NUMBER
1797	
MAIL DATE	DELIVERY MODE
11/20/2009	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/686,191	HAGEN ET AL.	
	Examiner	Art Unit	
	Tony G. Soohoo	1797	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *the REQUEST FOR RCE on 10 November 2009*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *56-102* is/are pending in the application.

4a) Of the above claim(s) *60-64 and 84-95* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *56-59,65-83 and 96-102* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *15 October 2003 and 13 April 2009* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Election/Restrictions

1. Claims 60-62; 63-64, and 84-95 are withdrawn from further consideration pursuant to 37 CFR 1.142(b) as being drawn to a nonelected species or an invention non-elected without traverse, there being no allowable generic or linking claim. Election was made without traverse in the reply filed on 11/13/2007.

2. The elected species was elected to species b2 the use of a high voltage power supply.

Claim interpretation

3. The claim uses the phrase that an orifice [feature/characteristic] is "systematically varied". The phrase may be interpreted with various meanings.

1) the orifice is "systematic" in that a particular system of a formula, or regular pattern/symmetry, provides the variation which is not a constant or even value.

or 2) is it merely inclusive of a deliberate variation which may encompass a recognizable or not recognizable pattern or symmetry which is varied on purpose to produce a desired output/effect"

or 3) the there is a full variance (i.e. a non-uniform, fully random varied)

4. A reading of the specification states:

[0550] As will be explained below, the arrangement of the orifices 80 on the tube 10 **may be varied in a variety of ways to achieve different results.** For example with reference to FIG. 7, in some embodiments, the first fluid 901 flows along fluid path 3 and then through substantially uniform orifices 80 which are arranged in one or more lines on the tube wall 30 out to the fluid path 4. They may be configured as "radial orifices" 85 perpendicular to the second flow path 4, or as angled orifices 86 at some oblique angle to the flow path 4.

[0596] In some embodiments where users need or desire to control drop size and location of drops, the direct contactor 2 includes graded orifice arrays. **The orifices 80 may have diameters changing in curvilinear fashion with a prescribed systematic**

method. In one embodiment, **the orifice area may be systematically varied e.g., the diameter of the orifices 80 is varied as the square root of the desired orifice area**. The orifices may be formed using lasers or other suitable orifice forming methods. The desired orifice area in turn is preferably configured as a function of spatial location. In this manner, users can control the positive differential ejection pressure across the tube to control the portion of the orifices through which fluids or liquids flow.

[0593] In other embodiments users make the orifice gradations in substantially discrete sizes. The orifices may be arranged in discrete sizes such that the drop size formed or micro-jet diameter and drop size distribution are **significantly varied as desired**. FIG. 9 illustrates one embodiment **which utilizes orifices of three sizes**. The orifices are further configured to increase in size and then decrease in size progressively along the longitudinal axis of the tube 10. I.e. orifices with smaller openings 89 are shown followed by medium sized orifices 80 and orifices with larger openings 87, which are followed by medium orifices 80 and then small orifices 89.

0599] Flow through an orifice is generally proportional to the square root of the differential ejection pressure across the orifice. A 100:1 turn down ratio of flow rate would conventionally or typically require a pressure difference of 10,000:1. To compensate for this phenomena, in some embodiments, the direct contactor may be configured to utilize the effect that at low differential ejection pressures, orifices of different sizes will selectively pass fluid through some passages and not thru others. Accordingly, the contactor may be configured such that the **orifices are varied with respect to both their size distribution or profile, number distribution, lineal net jet area distribution, and/or spatial net jet area distribution to obtain a desired flow rate** versus differential ejection pressure distribution while achieving a prescribed micro-jet or drop size distribution. For instance users can obtain a linear, quadratic or other variation of flow vs. differential ejection pressure instead of (or in combination with) the default square root relationship. This can expand the relative control at low differential ejection pressure. This can be used to expand the overall turndown ratio.

As best understood the phrase, is read in it broadest reasonable interpretation in light of the specification is read to encompass at mere variation of value, though not a recognizable regular pattern or symmetry or inclusive of a recognizable pattern (i.e. small, medium, large values of holes/spacing) , it is provided from that of a single value to produce a desired output/effect.

Claim Rejections - 35 USC § 112

5. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

6. Claims 56-59, 65-83, 96-102 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

7. Claim 56 is unclear in what is meant by "systematically varied", see discussion above regarding claim interpretation. Whereby there is no particular claim to two different particular values, one can not determine the variation and the system used in the "systematically" modifier. There are multiple interpretations, one can not readily determine the scope of the phrase.

8. Claim 102 is unclear in scope of "progressively varied distribution". One can not determine the meets and bounds. Absent an positive claims to physical values or a slope or gradient or formula, one can not understand what is the bounds of the "progressive" value.

Claim Rejections - 35 USC § 102

9. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

10. Claims 56-59, 70-76, 78-82 and 96-102 rejected under 35 U.S.C. 102(b) as being anticipated by Woilles et al 4859071

The Woilles et al (et al) reference discloses

- a fluid delivery system

- a duct 2

- an elongated fluid contactor 8, 10, 12, 16, 18, 14

- an inlet 32

- a plurality of outlet orifices 20, 22, 26 (fig 2) in the elongated fluid contactor where the orifice distributions, along a 1st curvilinear transverse direction along a surface of the contactor is one of (the choice of in this case):

(a) systematically varied, progressively varied, and non-uniform) spatial location (see location of 26 compared to 20, 22, fig 1 and that of locations of 20, 22, and 24) (Note that openings have an orientation position they do not lie in the same plane and lie in different three dimensional locations

(b) systematically varied, progressively varied, and non-uniform size

(c) systematically varied, progressively varied, and non uniform in orientation (see the directions of 20, 22, 24 and 26 are varied, systematically, progressively and non-uniform, see arrows fig 2), relative to one of the choice of: 1) the axial, 2) radial and 3) circumferential directions of the elongated fluid contactor, excluding a 1st or 2nd orthogonal directions transverse to the mean streamwise flow regions along the curvilinear path along the contactor surface curvature both radially about and circumferentially about the tube surface. (see markup figure

with the distribution angles, position, and sizes of the nozzle are all varied systematically in comparison to the other defined nozzles).

The desired flow distribution of the 1st fluid is provided by a plurality of outlet orifices nozzles, which as seen in figures 1 and 2, by a non-uniform distribution of spatial location and orientation.

The elongated fluid contactor and support 8, 16, 18 is made of a flexible sheet steel tubing, column 5, lines 45-48, and lines 55-56.

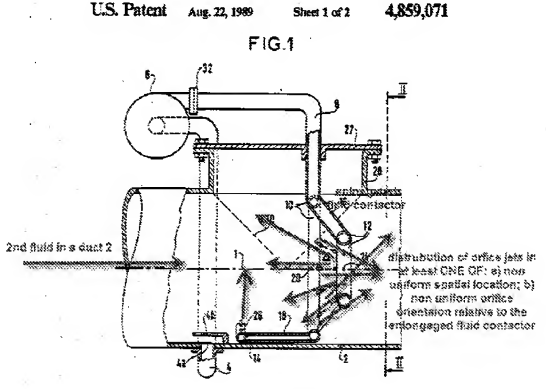
The structural of the elongated fluid contactor as shown by the reference is considered capable to function in a desired flow distribution of 1st fluid is provided by a plurality non-uniform spaced orifices 3, and on 5 or 4, in any distribution.

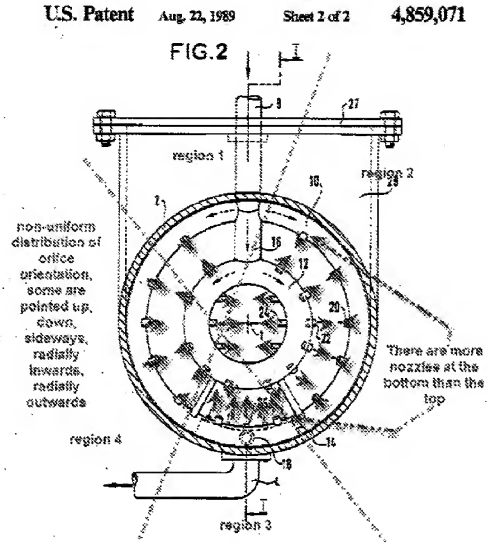
Note that the fluid contactor tube is formed from a conical, curved, thin walled tubular member extending transverse and along parallel in curvature into the flow path of the 2nd flow. There is also an elongation section 18 along the path of the pipe 2. Each of the elongation sections have a curvature radii along the length as seen in figs 1 and 2.

With regards to the mass flow rate volumes of flow, the flow rates provided of the 1st and 2nd flows are dependent upon the flow pressures operated by the device and does not distinguish the apparatus in a structural sense.

Regarding the clause "wherein the apparatus orifice distributions are configured to deliver[the operative function] at least one of a [choice of a resultant flow

characteristic]... " (see claims 99-100, "to deliver at least one of a prescribed [distribution of fluid(s)]"), such limitations of "configured to deliver" are directed to the operation of the delivery of the fluids (i.e. method of use of the orifices), however does not structurally limit the orifices to a particular geometry of structure or configuration. "Expressions relating the apparatus to contents thereof during an intended operation are of no significance in determining patentability of the apparatus claim." Ex parte Thibault, 164 USPQ 666,667 (Bd. App. 1969). "apparatus claims cover what a device is, not what a device does" (emphasis in original) Hewlett-Packard v. Bausch & Lomb Inc. 15 USPQ2d 1525, 1528 (Fed. Cir. 1990).





11. Claims 56-59, 74-76, 81-82, 96, 97, 99, 100-102 are rejected under 35 U.S.C. 102(b) as being anticipated by Stirling 5004484.

Stirling shows An apparatus for mixing a first fluid with a second fluid, the apparatus comprising:

a fluid delivery system for transporting the first fluid to a mixing region;

a duct 24 , 108 which defines a flow path for the second fluid through the mixing region; and

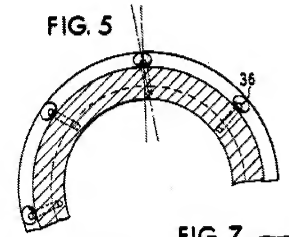
an elongated fluid contactor (Fig 5, 6,7) which forms a flow path for the first fluid from which the first fluid is delivered into the duct,

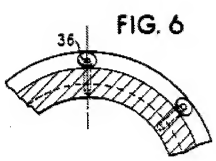
wherein the elongated fluid contactor includes:

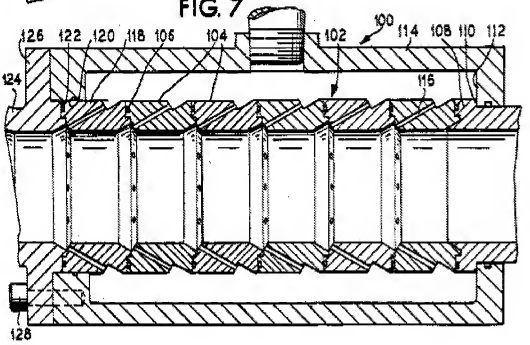
an inlet coupled to receive the first fluid from the fluid delivery system; and

a plurality of outlet orifices 36, 36, (figs 5, 6) providing fluid communication between the flow path in the elongated fluid contactor and the interior of the duct through which the first fluid is delivered into the second fluid;

wherein along a first curvilinear direction along , or circumferentially about the elongated contactor surface (see curve and circumference of figs 5,6, 7), **at least one of** the distribution of orifice orientation relative to the circumferential direction of the elongated fluid contactor, is **systematically varied .**







12. Claims 56-59, 70, 72-83, 96-102 are rejected under 35 U.S.C. 102(b) as being anticipated by Davis, Jr et al 4719748.

The Davis Jr et al reference (David) shows an apparatus anticipating the claims, see figure 3A, comprising:

a fluid delivery system for transporting the first fluid to a region;

a duct 14, 20 which defines a flow path for the second fluid through the mixing region; and

an elongated fluid contactor (Fig 3A) which forms a flow path for the first fluid from which the first fluid is delivered into the duct,

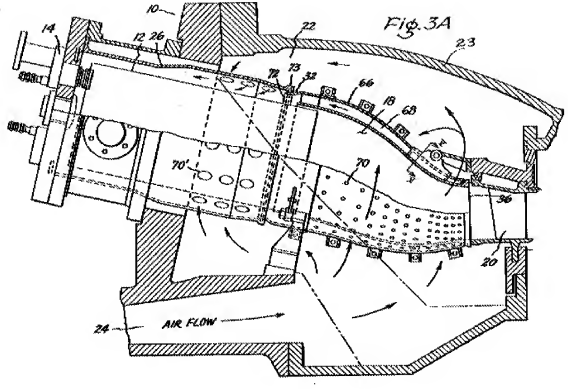
wherein the elongated fluid contactor includes:

an inlet coupled to receive the first fluid from the fluid delivery system; and

a plurality of outlet orifices 36, 36, (figs 5, 6) providing fluid communication between the flow path in the elongated fluid contactor and the interior of the duct through which the first fluid is delivered into the second fluid;

wherein along a first curvilinear direction along , or circumferentially about the elongated contactor surface (see curve and circumference of figs 3A), **at least one of** the distribution of orifice orientation, and/or size, and or spacing (see compare plural aperatues 70, and larger sized apertures 70' and the density of apertures 70 compared from the left , middle and right of the figure) relative to the circumferential direction of the elongated fluid contactor, is **systematically varied .**

U.S. Patent Jan. 19, 1988 Sheet 2 of 5 4,719,748



Claim Rejections - 35 USC § 103

13. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

14. Claims 68-69, 77 and 83 are rejected under 35 U.S.C. 103(a) as being unpatentable over Woilles et al 4859071 .

The Woilles et al 4859071 reference discloses all of the recited subject matter as established above with the exception of 1) the particular numerical value of the area and diameter of the Woilles' orifices (claims 68-69), 2) the orifices being of a non-uniform size distribution (claim 77), 3) the wall with the orifices being of a thinner wall portion than the other parts of the fluid contactor.

Regarding the first issue of the numerical values of orifice area and diameter, It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the area and diameter of the orifices so as to provide an effective ratio portion of material flow into the duct, since it has been held that discovering an optimum value of a result effective variable involves only routine skill in the art. In re Boesch, 617 F.2d 272,205 USPQ 215 (CCPA 1980).

Regarding the second issue of the orifices of a non-uniform size distribution, it would have been an obvious matter of design alter the sizes of the nozzles to a non-uniform distribution of sizes so as to optimize the material flow

across the cross section of the duct for a more effective and rapid mixing, since such a modification would have involved a mere change in the size of a component. A change in size is generally recognized as being within the level of ordinary skill in the art. In re Rose, 105 USPQ 237 (CCPA 1955).

Similarly, regarding the last issue of the contactor wall being thinner in the orifice section that the other portions of the contactor wall, it would have been an obvious matter of design choice to alter the thickness of the steel sheet tubing to be a smaller thickness at the orifice section so as to lower material costs, since such a modification would have involved a mere change in the size of a component. A change in size is generally recognized as being within the level of ordinary skill in the art. In re Rose, 105 USPQ 237 (CCPA 1955).

14. Claims 65-67 are rejected under 35 U.S.C. 103(a) as being unpatentable over Woilles et al 4859071 in view of Tsouris et al US 2003/0086333 and Paine 3570513.

The Woilles et al 4859071 reference discloses all of the recited subject matter as established above with the exception of the fluid delivery system comprising a high voltage power supply to establish an electric field modifying the flow of the 1st fluid delivered by the orifices.

The phenomenon of electrohydrodynamic (EHD) effect in cooperation in a control of fluid flow is old and well known in the art of fluid control and mixing. This is evidenced by the 1971 patent of Paine, US 3570513 in which high voltage is provided across electrodes for production of an electric field to affect fluid flow as use as a electrohydrodynamic control valve. Furthermore, the use of (EHD) techniques (and control) has been proposed within a channel flow assisting the mixing of fluids, See Tsouris et al US 2003/0086333. In light of the knowledge gleaned by the prior art, it

would have been obvious to a person having ordinary skill in the art at the time the invention was made to further provide the fluid delivery system with a high voltage power supply to establish an electric field modifying the flow of the fluid delivered by the orifices of Woilles so as to provide a control of the interaction of the fluids for a more effective mixing interaction.

Response to Arguments

15. Applicant's arguments filed 10/11/2009 have been fully considered but they are not persuasive. Applicant alleges that the claims define over the prior art in that the prior art does not show any one of a 1) "systematically varied" orifice spatial location, 2) systematically varied" orifice size, or 3) "systematically varied" orifice orientation.

16. Phrase "systemactically varied" is a compartive term, thus one must establish baseline of measurement and a comparative measurement so as to determine a variation has, in fact, occurred. Since the claim is vague in the frame of reference and prior art shows nozzle orifice in differing locations (there are more orifices per section near bottom than the top across the cross section pipeline, and different orientations (some point up, some point down, some point sideways, see markup figure of Woilles).

17. The examiner respectfully notes that applicant's characterization of the alleged "uniformity" and uniform features of the Woilles reference is unpersuafive since applicant describes a further additional "relative" measurement which was required in the claims as a limitation. The claims do not have language describing the systematic variation with such precision as argued. Although the claims are interpreted in light of

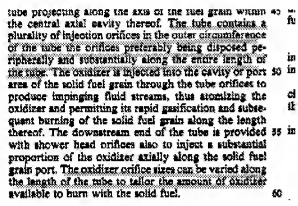
the specification, limitations from the specification are not read into the claims. See *In re Van Geuns*, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993).

18. In fact, applicant acknowledges that some of the nozzle orifices point in opposed to one another. Is it not true that since some of the orifice openings point in one direction, and the other orifice openings are pointed in the other opposite direction, this would mean that the orifices are systematically varied in that some point some point outwards and some point inwards, see nozzles 24/22, or 22/20.

19. Regarding the argument that the claims require a "progressive variance" is not well taken by the examiner. The scope is unclear in what is the degree of meaning as to be "progressive". The phrase is read in its broadest reasonable interpretation that the variance has a change. As discussed above, the prior art shows opening orifices pointing in different directions. When measured from one single point as the frame of reference, the change in direction is understood to be progressively varied in different directions.

Conclusion

20. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Brilley 5101623 teaches that orifices of an inlet tube may be of difference sizes along the length to provide an appropriate entry of fluids from the tube into a conduit, col 1, lines 45-60.


tube projecting along the axis of the fuel grain within the central axial cavity thereof. The tube contains a plurality of injection orifices in the outer circumference of the tube the orifices preferably being disposed peripherally and substantially along the entire length of the tube. The oxidizer is injected into the cavity or port area of the solid fuel grain through the tube orifices to produce impinging fluid streams, thus atomizing the oxidizer and permitting its rapid gasification and subsequent burning of the solid fuel grain along the length thereof. The downstream end of the tube is provided with shower head orifices also to inject a substantial proportion of the oxidizer axially along the solid fuel grain port. The oxidizer orifice sizes can be varied along the length of the tube to tailor the amount of oxidizer available to burn with the solid fuel.

21. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Tony G. Soohoo whose telephone number is (571) 272 1147. The examiner can normally be reached on 8AM-5PM, Tues-Fri.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Walter Griffin can be reached on 571-272-1189. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Tony G Soohoo/
Primary Examiner, Art Unit 1797

Tony G Soohoo
Primary Examiner